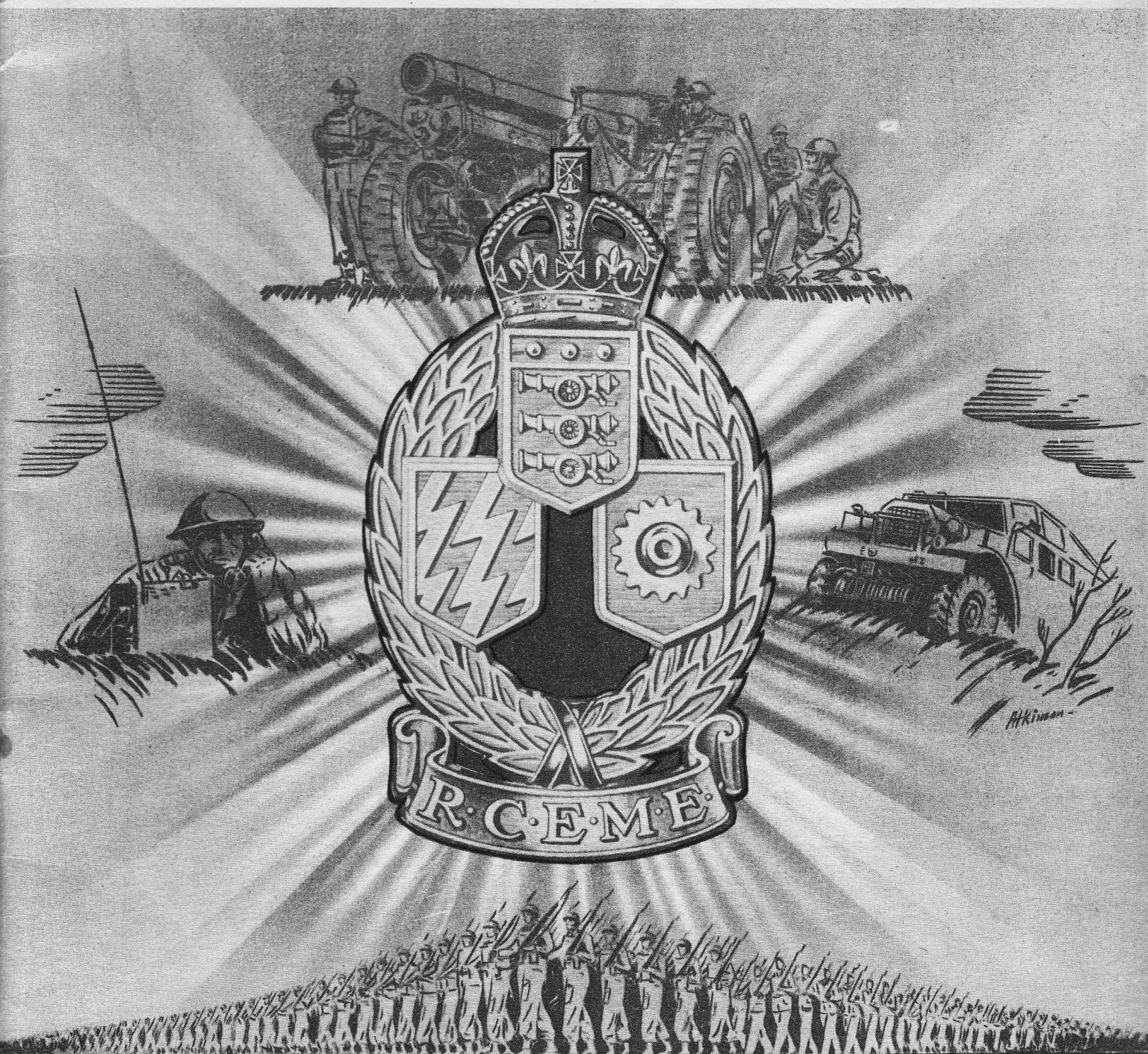


CAM

Published by the Directorate of Mechanical Engineering, N.D.H.Q., Ottawa, Canada



VOLUME 1 NUMBER 9

JUNE 1944



JUNE — 1944
VOL. 1 No. 9



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This has been a tremendous undertaking but after nearly five years the results are astounding. Among those who have been trained in these electrical and mechanical trades were many who found the work completely new to them. However these men were picked to follow a certain trade not because of previous knowledge of the subject but because it was thought they could readily adapt themselves. This contention has been fully justified by results. These men, no matter how arduous their training, considered it their job and rightly so for without them the army could not move.

Our Army has been supplied with the best of tools and equipment, but from the first, leaders realized that no tool or piece of equipment is any better than the man who uses it. This is true regardless of what skill you have been called upon to acquire, or what type of tools or equipment it is necessary for you to use. Your part in this war then is to develop an expertness in the use of tools and equipment that cannot be matched by the enemy. This can only be attained by conscientious study and diligent application of the instructions given to you.

Remember, you are a member of the Royal Canadian Electrical and Mechanical Engineers and as such, are expected to maintain the high standard of efficiency necessary to victory.

CAM is published monthly in the interests of Mechanical Maintenance, and directed to the non-commissioned officers and men of the Canadian Army.

Your contributions of articles and ideas are welcome. Address all correspondence to the Editor, CMAA, Directorate of Mechanical Engineering, Department of National Defence, Ottawa.



R.C.E.M.E.

The Corps of Royal Canadian Electrical and Mechanical Engineers

A major reorganization of the repair and maintenance services of the Canadian Army both overseas and in Canada took place when, on the 15th of May 1944, a new Corps, the Royal Canadian Electrical and Mechanical Engineers, came into being.

The function of this new Corps can be set down under four main headings.

First—Inspection and Maintenance of Wheeled and Tracked Vehicles, all artillery (including field, anti-aircraft and coast defence), small arms and machine guns, radio-location, fire control and all other instruments, signalling equipment and transmitting sets and the installation of coast artillery machinery.

Second—the recovery and repair of all the above equipment consequent upon ordinary wear and tear or battle casualties.

Third—Investigation into defects of design and recommendation for improvements.

Fourth—Advice on prototype design from a maintenance angle.

Thus the R.C.E.M.E. have assumed the chief responsibility for maintenance and repair for the Canadian Army—a job that previously had mainly been carried out by the R.C.O.C. in addition to their responsibilities for the provision and supply of technical stores, general stores and clothing.

Forming an inalienable part of this responsibility is the close liaison

With the thought that there may be quizzical frowns on the faces of many people in the field as to just what the function and general set up of this new R.C.E.M.E. Corps is, CAM herewith attempts to set forth a brief and general low down for the benefit of those Joes who have become part of the new corps and also to all other "issue dressed" interested parties.

From where we sat, in our little padded corner of a big building in Ottawa, it looked as though a bit of "info" on the why fo was called fo—so here 'tis—as we see it.

between R.C.E.M.E. and the Designing Engineers, the Manufacturers, the Inspection departments and Procurement branches. Similarly the factors of unit maintenance in relation to unit responsibility for the equipment on charge together with the training of operators, mechanics and general tradesmen is encompassed within these ramifications.

The R.C.O.C. will continue to hold the spare parts for repairs but R.C.E.M.E. will hold in their workshops only a working stock of such spare parts. This necessitates the closest co-operation between the two corps.

Certain electrical and mechanical engineering duties have also been transferred to R.C.E.M.E. from R.C.E. and R.C.A.S.C. The R.C.E. however,

continue to be responsible for the provision and repair of certain equipment peculiar to themselves, and the R.C.A.S.C. continue to operate Workshop platoons of R.C.A.S.C. personnel which form an integral part of their transport companies and carry out repairs within the R.C.A.S.C. forward areas.

Obviously the rapid increase in the use of technical equipment for military purposes during the present war has brought with it the need for an immense and ever increasing volume of maintenance and repair. And these maintenance and repair services must be designed to keep such equipment in the highest state of efficiency under all conditions.

Therefore, with this in mind, the R.C.E.M.E. was authorized with two main objects in view. (a) to provide more satisfactory direction and co-ordination of maintenance and repair services. (b) to provide more economical use of skilled manpower in the Canadian Army.

Canada has the advantage of precedent in the parent British Corps. The formation of the R.E.M.E. Corps in the British Army was the result of exhaustive study and investigation over a period of years by several committees of high ranking officers and eminent industrialists. One of the most outstanding reports in this connection was that of Sir William Beveridge's Committee on the 'Use of Skilled Men in the Services', presented by the British

Minister of Labour and National Services to Parliament. Para. 44 of this report, which proposes the formation of a Corps of Mechanical Engineers in the British Army reads in part as follows:—

"A Corps of Mechanical Engineers

.....that the Navy has had, for so long, an engineering branch of high authority and has had other technical branches specialized on torpedoes and electricity.....The Navy is machine-minded. The Army cannot afford to be less so. The Navy sets Engineers to catch, test, train and use Engineers. Until the Army gives to Mechanical and Electrical Engineers, as distinct from Civil Engineers, their appropriate place and influence in the Army System, such engineers are not likely to be caught, tested and trained so well as in the Navy; there is danger that they will be misused by men whose main interests and duties lie in other fields."

It is not surprising then that in 1942, on the 1st of October of that year, the R.E.M.E. Corps came into being in the British Army. The progress and operation of this British Corps has been closely watched and has been the object of constant study by officers concerned with maintenance and repair in the Canadian Army. Based on these studies and observations and after much deliberation of the various phases of maintenance and repair, both in Canada and the Canadian Army in the field, it was decided to regroup the maintenance and repair services during wartime.

The bulk of the personnel for the new Corps were drawn from the maintenance and repair groups and units of the R.C.O.C. The officer personnel of the corps consists of Electrical and Mechanical Engineers and Mechanical Officers, whilst of the Quartermaster category there are Assistant Electrical and Mechanical Engineers, Assistant Inspectors or Armourers Services and

Workshop executive Officers.

To qualify as an E.M.E. Officer, candidates must be in possession of a degree of B.Sc. in Mechanical or Electrical Engineering or have good practical mechanical or electrical engineering experience and general education suitable to the needs of the R.C.E.M.E. Corps. The appointment of Mechanical Officers is restricted to personnel in possession of sound practical experience and general education suitable to the needs of vehicle maintenance. Officers of the Quartermaster category are appointed from the ranks of the Armament Artificer, Artisan and Armourers sections.

Other ranks of the R.C.E.M.E. Corps can be divided into five sections or categories, namely: Armament Artificers, Armourers, Artisans, clerks and storemen, and general duty—non tradesmen.

How will the R.C.E.M.E. Corps function in the field? There again the tried and proven British counterpart provides the model. Called the Echelon System of Repair the system is composed of four echelons—or zones, each with a definite normal function, which combined with the considerations of the types of equipment to be served, at once fixes the corresponding repair equipment to be provided to each R.C.E.M.E. Unit and also the technical personnel and stores required.

By confining the lower echelons (1st and 2nd) to minor and quickly made repairs and adjustments and the exchange and replacement of assemblies, the higher 3rd and 4th echelons equipped with greater facilities in equipment and personnel perform the major and more involved repairs.

First echelon repairs consist of adjustments and light repair, which are carried out both by the Unit concerned and R.C.E.M.E. personnel in the form of Light Aid Detachments, the latter in general carrying out

minor repairs beyond Unit capacity and assisting the Unit in recovery. The Light Aid Detachment, the smallest type of R.C.E.M.E. Unit, is commanded by a subaltern or warrant officer and is wholly identified with and under the same command as the Unit, Regiment or Brigade which it serves. To Light Aid Detachments fall the task of locating casualties and, if possible, repairing them on the spot. Another chief function of an L.A.D. is to keep the roads clear for movement.

Behind the Light Aid Detachments and situated in the Divisional area are the Brigade Workshops. These are divisional troops, but are normally allocated to Brigades which they serve. Their basic function is repair by assembly exchange—designated as 2nd echelon repairs.

Brigade Workshops, as with all types of R.C.E.M.E. Workshops in the field are divided into specialist sections to deal with different classes of equipment and are correspondingly scaled as regards technical personnel and facilities.

Thus each repair section is based on the class of repair, quantity and type of equipment to be maintained, average frequency of repairs and the mobility required of the Workshop.

The equipment and facilities of these units take the form of machinery lorries of various types—thereby providing the necessary mobility and lending itself to organized dispersal and camouflage in order to present a difficult target for enemy aircraft and artillery fire.

They work in close liaison with the Light Aid Detachments in front of them; and under certain circumstances, an advanced Workshop detachment is formed from the Workshop Unit personnel and equipment for carrying out repairs on the spot which are beyond the capacity of the L.A.D. and Unit maintenance personnel. This arrangement overcomes

(Continued on page 149)

The Ventilator Valve

Sometimes called a Hydravent valve. Sometimes called a *!x-!c—but it's boss of the crankcase ventilating system and a fellow we think you should know.

THERE'S a pound or so of hardware on your truck engine that didn't used to be there until fairly recent years. For this reason it's possibly regarded as a frill put there for the sole purpose of adding another grey hair to the poor driver's overworked brain thatch.

Such is really not the case. This plumbing is part and parcel of the Crankcase Ventilation system—and so far as Army Vehicles are concerned, crankcase ventilation rates in importance with using the right oil in the crankcase.

That's fine, you say, but plenty of commercial truckers have been getting along for years without this hardware so now why shouldn't the Army? Well, the Army soon found out that they operated their trucks differently. They specialized in stop and go driving. No pushing along hour after hour all day and night the way the commercial trucks do.

A 30 cwt is yanked out of a park—zing, rushed to a stop at the docks. It sits and cools its tires while being loaded. Then off to a supply dump. Another wait while unloading. Back again, go, wait, back, wait, go, wait. This jerky operation never lets the engine get up a decent operating temperature.

Now, if you were blessed with the right kind of eyes for seeing through engine blocks, you'd get the messy picture of water vapour being blown by the piston rings and down into the crankcase. That's always hap-

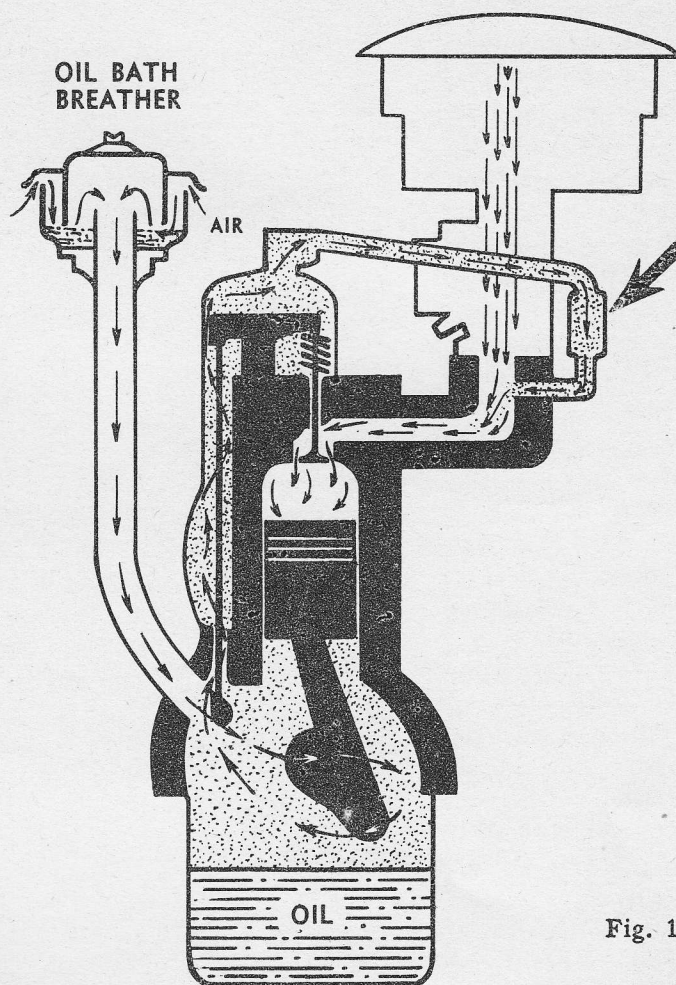


Fig. 1

Here's the engine sliced open right smack in the middle of the intake stroke—showing the "pull" of the intake manifold drawing the blowby and air up out of the crankcase.

pening. But since the engine's not up to normal operating temperatures these vapours condense and form water when they touch cold metal in the crankcase. As water they start their dirty work of rusting and corroding those fine precision parts. More condensation drips down into the oil and eventually shows up as sludge. Sludge as you know is that thick oozy muck that forms in the crankcase with the prime purpose of clogging filters and oil ways, cor-

roding pistons and bearings with its water content and generally raising hell all over the inside of your motor.

Like everything in war—every weapon has its counter measure, and ever since the crankcase ventilating system was put on, the picture inside the engine has become less gruesome. The system's job is to draw off the water vapour before it can condense, by circulating cool sweet air through the crankcase and out again. Different makes of vehicles do this a

little differently and get the same results. For instance Ford and Chrysler bring the fresh air in directly to the crankcase, up through the valve chambers and into the intake manifold. G.M. Valve-in-head jobs bring it into the top of the valve cover, down the push rod chamber, through the crankcase and back to the intake manifold.

Fig. 1 gives you a sliced through view of a composite engine designed to show the "how" in one simple shot. They all work like this.

As you can see the harmful damp vapour breezes are sucked from the crankcase up to the valve chamber, along a pipe, through the ventilator valve and into the intake throat of the carburetor—the suction effort being provided by the vacuum in the intake manifold. Fresh air comes in by way of the breather pipe and replaces the vapours vented out. That's the only way air is supposed to get in, so it's thoroughly cleaned by an oil bath air cleaner on the filler pipe before being admitted to the inner vitals of the engine. Air sneaking in through leaks in the valve covers and/or push rod covers, or other places

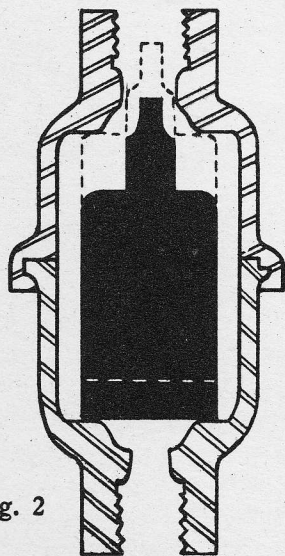


Fig. 2

Simple Simon—just a weight and a needle valve—the dotted line shows how the needle restricts the opening when the weight moves up.

in the crankcase, comes in loaded with dust and other corruption. Leaks in the system are bad for another reason too. The Ventilating system pulls in air through them instead of pulling out the vapours from the crankcase. So you can see that the ventilating system can't do a good job unless the engine's sealed as tight as a Nazi's future.

Apart from keeping things air tight and seeing that the filter is properly maintained (for facts on Filters see last month's CAM) the only spot that will gum up the works, if you forget about it, is the little ventilator valve, usually known as the Hydro-vent.

This valve controls the system and the valve in turn is controlled by the vacuum in the intake manifold.

When the engine is idling and the vacuum in the manifold is **strongest**, the valve stays **closed**. Just a fine sliver of air is pulled through the valve into the manifold. There isn't much ventilating to be done when the engine's idling anyway—not much blowby is coming down past the rings into the crankcase. It's another story when the engine is "**revving**" **fast** or pulling hard. Then the vacuum in the manifold is at its **weakest**. The crankcase is stuffed full of blowby. And that's when the ventilating valve opens widest to take out as much of the blowby as it can. The idea being that no matter how you run your vehicle your ventilating system gives you a sweet crankcase. That spells a healthier engine.

There are two types of ventilator valves that you will find on crankcase ventilating systems. The simplest one of the two (Fig. 2) consists of a small weight which moves freely in an outer shell. At the upper end the weight is shaped into a pin-like metering valve with a small diameter at the top and a larger diameter lower down. The top end of the pin fits loosely into the top orifice of the outer shell while the larger di-

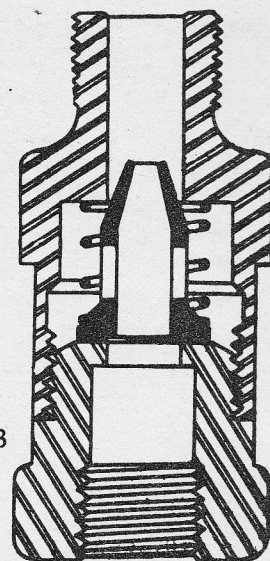


Fig. 3

The newer type—more bits and pieces but less liable to stick. You'll note it comes apart for easy cleaning.

ameter just about fills the passageway. This valve assembly must be installed so that it is vertical, with the arrow that's stamped on the outside pointing up.

Like we told you its job is to stop excessive oil vapour being drawn from the crankcase when the engine is idling and the manifold suction is highest. This strong suction lifts the weight so that the pin in the top fits in the orifice thus greatly restricting it. As the engine revs go up and we want more ventilation, the vacuum pull from the manifold drops lower—and lets the weight drop—thus opening the passageway and giving us our extra flow of vapour laden air.

The second type is a newer version and somewhat less common. It works on the same idea (Fig. 3). Instead of the weight it uses a restrictor valve—which is similar to a needle valve except that it has a passageway through its centre. A coil spring calibrated to just the right pressure is used to hold the valve away from the top opening at high speed (when the manifold suction is low) and yet will permit the valve to be pulled up by the higher vacuum at idling speeds, thus

giving the required restriction.

The reason for the use of this spring loaded job is to overcome the tendency of the "weight" type valve to stick due to it gumming up from the vapours passing through. This type valve should be cleaned at regular intervals (CPMS 5 is suggested as a good spot to do the job) by removing it, taking it apart and cleaning each part with a gum removing solvent. That's just a suggested interval. You may find the valve gets clogged up sooner—in which case hop to it with the cleaning sooner. Even some clean valves can cause trouble. Especially when one of our inventin' mechanics gets fooling around with the spring. He'll try s-t-r-e-t-c-h-i-n-g it, or snipping off a coil or so to get more or less draw from the system. But fellow, that spring's been engineered for a specific job. Changing it won't let the valve open at just the right time or close at just the right time. You won't get the best ventilating efficiency. The spring that came from the factory is O.K.—we'll vouch for it.

The weight type valve will also require attention along this line. The operation of this type can be easily checked without removing it—this-away.

Have the engine idling and place your hand on the body of the valve. Quickly open the throttle and you

should be able to feel the valve drop. If you can't check the pipe connections for airtightness. If everything is O.K. here and the weight still doesn't drop when you open the throttle—the old cleaning treatment is called for. Some of the "weight type" valves do not come apart, in which case you have to swish the whole valve around in the solvent and blow it out with the air gun. While you're at it, give the tubing and fittings a similar going over to remove their collection of gum and trash.

All in all, it's worth the required small effort to keep this little ventilating valve in working order. You can see how the ventilation of the crankcase is a big factor in engine life—whether your crankcase gets its ventilation depends on the workings of this little valve. If it sticks up in the fully raised position no ventilating, to speak of, is getting done. If it gums up in the fully open position there's too much suction on the crankcase at small throttle openings. Besides gumming up the valve still worse—you'll probably have to start losing sleep wondering why your vehicle has suddenly started to guzzle oil. Out in a battle zone—this is serious enough to cause you more than loss of sleep.

So there you have it—keep your ventilating system up to snuff and you'll keep your crankcase from getting cranky.



On some vehicles the towing hook is seldom used and when bare metal is exposed to all kinds of weather for very long you know what happens—it usually rusts solid.

Of course no one ever thinks about the towing hook 'til they have to use it and there's when the struggle begins.

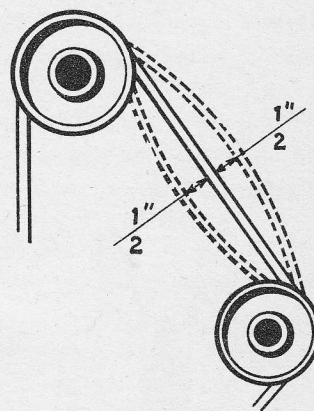
Just so you or the next fellow doesn't have to grunt and groan to get the towing hook in operation—how about putting a few drops of oil on the pivot pin everytime you do a grease job on the vehicle.

If you find any vehicles that have already got rusted towing hooks, saturate the pivot pin with penetrating oil. After the penetrating oil has had time to soak in, the pivot pin can probably be freed up. Then with a few drops of heavier oil the pin will stay free 'til the next time the vehicle gets a grease job.

Not all of the towing hooks and clamps look like the one we have shown—but they all like a little bit of oil once in awhile.



Too loose or too tight adjustment of the fan belt—just like shall we say—the wartime girdle, is bad business. When too slack, considerable wear through slippage takes place on the fan belt—not the girdle). Also, when the motor is revved up, resistance of the fan blades cutting the air tends to hold back the speed of the fan, and the belt doesn't pick up the speed applied by the crank driving pulley. The generator speed and output is thus retarded through this slippage.



On the other hand, when the belt is too tight (it's very uncomfortable if we keep the girdle in mind) we not only str-e-t-c-h the fan belt, but we put a terrific strain on the generator bearings. This of course is caused by the side pull on the pulley.

The manufacturers tell us that a Fan belt (not a girdle) adjusted correctly, will have one inch of play. Just get hold of it with your lilly white hand and measure the movement. (In the best of circles this check is made with the engine stopped). Now you know why it's one of the important checks on you daily C.P.M.S.

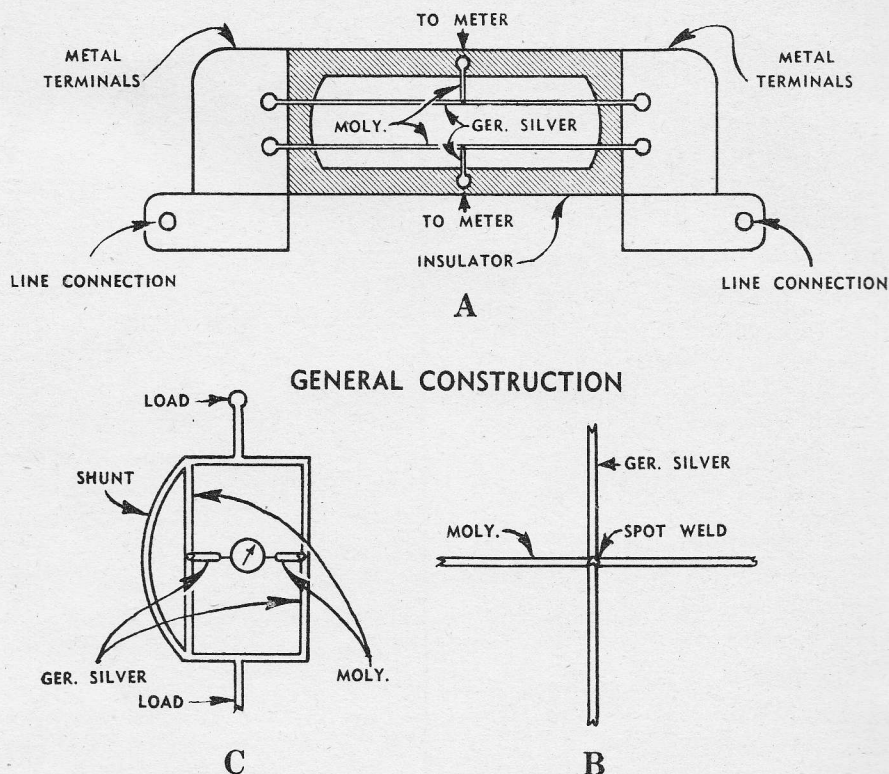
R.F. Ammeters



Shorty Sirkit has word of a fix for taking these Ammeters off the N.S. list.

IN keeping with our policy of passing on the "Kinks" sent to us by Telecommunication's Personnel in the Workshops we dove into the wastepaper basket where we file our most treasured items and came up with one of the numbers we promised you last month. This one, along with several others that we will hand on as soon as they have been checked, comes from Armt/Q.M.S. Walt Minoway of the Dundurn Wireless Workshop. Walt has been working on several ideas for making things do jobs they were originally not intended to do and the one we are outlining below should help to put those R.F. Ammeters back into shape. You know the meters we mean. The ones Joe has been using to check batteries with. The following information should make it possible for you to get those meters back into operation in no time, and better yet, without having to indent for parts. The only materials needed can be obtained from an old wirewound resistor and any old valve more complicated than a diode.

The Thermo-couples used in R.F. Ammeters, as all good wireless Mechanics know, are miniature generators of D.C. potential that depend for their operation on the fact that two dissimilar metals when joined and heated assume different potentials. This potential can be measured in millivolts and when applied across the terminals of a sensitive D.C. am-



meter will cause the meter to give a reading. The point that interests us is the fact that the source of the heat applied to the junction is unimportant as far as the meter operation is concerned. This means that we can use an electric heater to cause the potential difference between the two metals. More interesting still is the fact that we can make our heater from one or both of the metals and that is just what has been done in this case. A little study of the accompanying diagrams should make this clear. Now, since the potential difference between the two metals depends on the amount of heat applied to the junction and the heat depends on the amount of current

flowing through the heater we have a way we can measure the amount of current flowing through the heater by the reading of the meter. To add more to our blessings the amount of heat generated depends on the effective value of an A.C. so we can calibrate our meter in effective (or RMS) amperes or milliamperes. The Thermo-couple shown is actually two thermo-couples in parallel, with the junctions in series as far as the meter is concerned. In order to construct these, we first remove the grid wire, which is made of Molybdenum from a N.S. valve and straighten it out so that lengths suitable for our mounting are at hand. Next we

(Continued on page 160)

Tank Propeller Shaft Whip

A propeller shaft is a pretty solid object to look at—or to have to carry very far.

Offhand we don't know of a circus strong man who could bend one.

Yet some Army tank drivers can do it as easy—shall we say—as moving a throttle lever, or depressing a clutch pedal.

How? With a recipe known as propeller shaft whip, thats how.

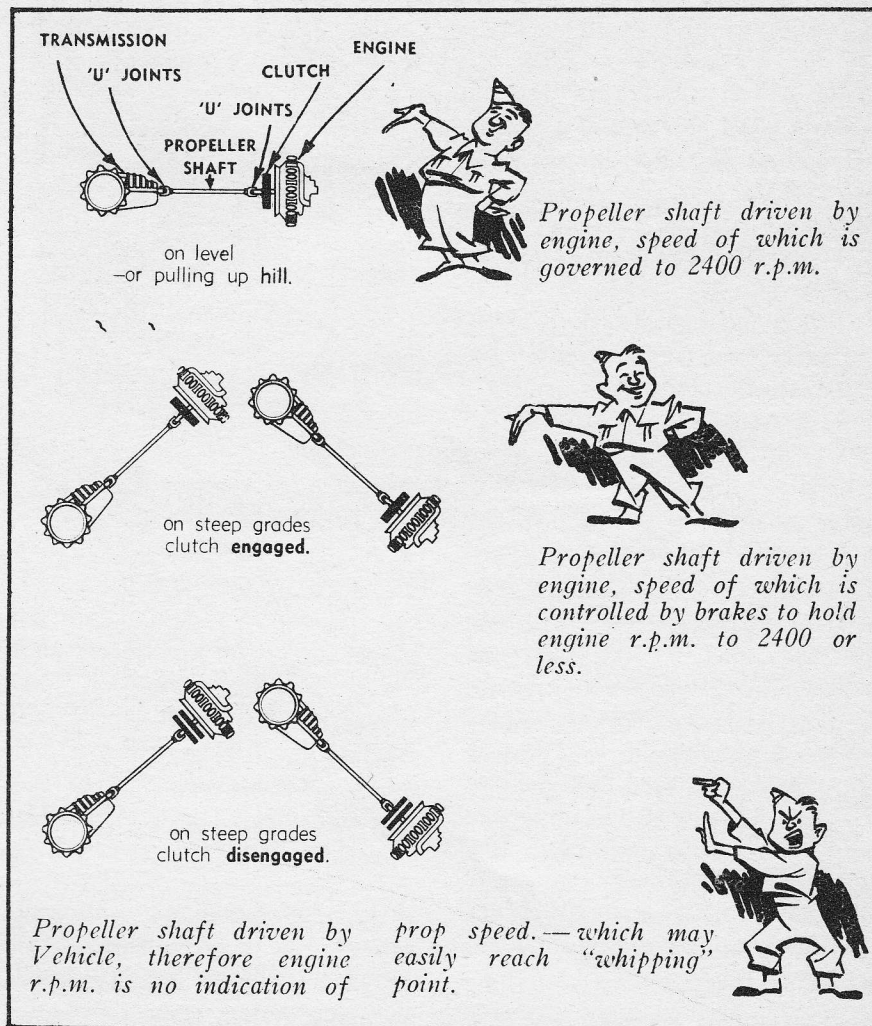
When prop shafts whip, trouble is just around the corner. Trouble in the form of damage to the universals, scoring of the shaft due to it fouling the propeller shaft housing bolts—and complete failure of the shaft.

From the reports coming in from the field, at home and overseas, this whip is accounting for a whole flock of prop shaft failures in medium tanks.

The remedy? Preventive Maintenance—and you don't even need a tool kit to carry it out. Just a simple rule to tuck under your tank helmet (we're assuming you know the rule to get into the same gear to go **down** a hill as you would use to go up) so here'tis—in two easy steps.

ON DOWN GRADES NEVER DIS-ENGAGE THE CLUTCH and KEEP THE ENGINE SPEED BELOW 2400 RPM. BY USING BRAKES. How's remembering this rule going to stop prop shaft failures? It won't—but remembering to follow it will, and here's why.

With the clutch **engaged**, the propeller shaft turns at engine speed (governed to 2400 rpm.). When you allow the tank to drive the engine up over 2400 rpm. when going down grades, the prop shaft not only starts



to whip but the clutch may fly apart and the engine beat itself to bits.

With the clutch **disengaged**, the engine and clutch are safe from harm—but the propeller shaft speeds up in ratio to the speed of the vehicle. The tachometer doesn't tip you off to this—only the mph. of the vehicle. Just to show you how slowly you can go to get into trouble fast—here are the vehicle speeds in each gear at which the prop shaft reaches its critical rpm.

| | |
|----------|----------|
| 1st gear | 4½ mph. |
| 2nd gear | 10½ mph. |
| 3rd gear | 18 mph. |
| 4th gear | 29 mph. |
| 5th gear | 45 mph. |
| Reverse | 6 mph. |

Now forget them—and instead, do the easy thing. Soak up an eyeful of the sketch and follow the rule—On steep down grades never disengage the clutch and keep the engine speed below 2400 rpm.



SERGEANT O'Sweat sauntered over to where Pte. Halftrack was attempting to extract a broken blade from a hacksaw which got jammed in a piece of sheet metal—Halftrack cocked his head at a slight angle, leaned on his vise, and with a hopeful glance at O'Sweat, said boldly, "Well, Sarjunt, guess we'll have to slip a new blade into 'er!"

O'Sweat walked slowly around the workbench, examined the job, and in the way Sergeants have of getting an idea across to their students, said:

"D'ya happen t'know why it broke?"

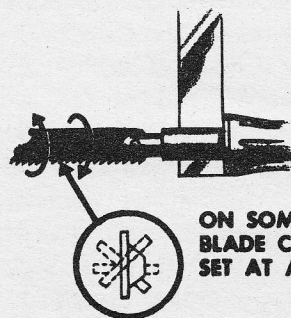
"No", peeped Halftrack.

"Well" said O'Sweat, "I'm going to make a futile attempt to explain the workings of a hacksaw to you. I think we'd better get the rest of the boys over here and all of us get straightened out on the use and abuse of a hacksaw."

O'Sweat cleared his throat—"Girls", he snorted, "The hacksaw is used to saw metal. There are two parts to a hacksaw—the frame and

the blade. Practically all hacksaws now are made with an adjustable frame designed to take blades which are 8, 10, or 12 inches long. Some frames are made with a pistol grip handle. Recently, several manufacturers have developed frames with the handle in an inverted position. The theory of this design is that the force applied on the forward stroke of the saw is delivered in a direct line with the blade."

"All adjustable hacksaw frames are made so the blade can be installed in a vertical or horizontal position. In some of the more expensive, better designed frames, the saw blade can be positioned at various angles between the vertical



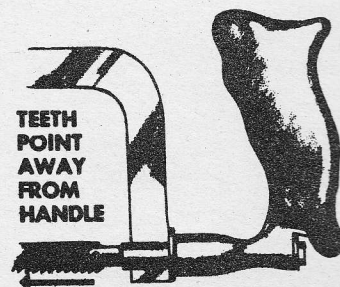
ON SOME FRAMES
BLADE CAN BE
SET AT ANY ANGLE

and horizontal positions. Often there is an advantage in having a hacksaw of this type because it enables the mechanic to use the saw in places where there would not be sufficient clearance for the conventional saw with only two positions for the blade.

"When placing a blade in a hacksaw frame, first see that the frame is correctly adjusted for the length of the blade with sufficient remaining to permit the blade to be tightly stretched."

"Place the blade on the pins so that the teeth point toward the **front** of the frame—away from the handle. Always screw up the adjustment so that the blade is rigid in the frame. A loose blade will break quicker than the heart of a jilted bride."

"Y'see bright-eyes?" Said O'Sweat, neatly sawing a knuckle from Halftrack's hand. "In starting a cut which is being made to a marked line it usually is a good idea to use the thumb of the left hand to guide the blade until the cut is started at the desired location. Use sufficient pressure in starting the cut so that the saw immediately begins to bite



TEETH
POINT
AWAY
FROM
HANDLE

into the metal. The cutting action of a hacksaw blade and a file are similar—if you don't use sufficient pressure so that the teeth actually bite into and cut the metal, you get a rubbing action which helps dull the teeth. When sawing, ease up the pressure on the return stroke of the blade in the same way you would when filing. You don't have to lift the blade off the work when the saw is being started. But when the kerf

—that's the name for the slot made by the saw—becomes deep enough to guide the blade, the saw blade can be raised slightly off the bottom of the kerf on each back stroke."

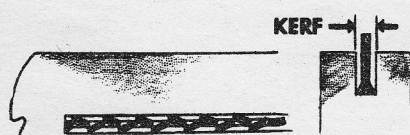
"For best cutting results in metals of average hardness the saw should be worked at the rate of 40 to 50 strokes per minute. If the saw is worked too fast, (it doesn't matter if Halftrack misses this bit, so let him sleep) there may be sufficient heat generated by the cutting action of the teeth to draw the temper and ruin the blade. So in cutting harder metals, the number of strokes per minute should be cut down. There's a limit to the hardness of metal that can be sawn. Before ruining all the teeth on a blade, test the metal with the very front or rear teeth or with the tip of a file to see if it can be cut."

"Except when you are getting the saw started, always use as much of the full length of the hacksaw blade as possible on every stroke. Keep the blade moving in a straight line to avoid any twisting or binding action. And again, use enough pressure to keep the blade from getting pinched or jammed as this often breaks some of the teeth or breaks the blade."

"That ain't all fellow humans and Halftrack. While we're on the subject, I wanna warn you about sump'n you do if a blade breaks."

"If a blade breaks and you have to finish the operation with a new blade, always start a new cut with the new blade if possible. If you are sawing a round piece rotate it and start a new cut in line with the first one. If you are sawing a flat piece,

(Continued on page 160)



SET OF TEETH PROVIDES CLEARANCE FOR BLADE

R.C.E.M.E. . . .

(Continued from page 142)

the need for recovery of a large percentage of casualties to the parent workshop. These advanced workshop detachments—while they cannot be regarded as a cohesive field workshop—are highly mobile and consist of a number of servicing detachments.

Third echelon repairs are defined generally as assembly repair by exchange of components, whereas complete overhauls and rebuilding comprise 4th echelon repairs. Where absolutely necessary 4th echelon Workshops carry out manufacture of components.

Workshop Units whose basic function is 3rd echelon repairs may be situated in the Corps or Army area. These units are semi-mobile and although they are actually corps troops their location is often a matter of mutual adjustment between Army and Corps headquarters. They are not required to move frequently and their transport is limited. 3rd echelon shops in many cases also share the work of 2nd echelon units during rush periods and sometimes even take their place in an emergency.

Finally there is the 4th echelon represented by the large base and advanced base workshops. These workshops are on fixed sites, the equipment being scaled to undertake continuously the heaviest type of repairs. Power light, heat, water, road and rail access are essential if such workshops are to function efficiently within reasonable time limits.

The evacuating of heavy vehicles and armaments to rail or road heads for clearance to 3rd and 4th Echelon workshops is carried out by the R.C.E.M.E. Recovery Companies.

Under normal conditions the L.A. Ds. and Brigade Workshops carry out recovery operations in the Divisional Areas. However in circumstances where heavy casualties occur, sections from these Recovery Companies,

amply supplied with heavy tank transporters, breakdowns etc., move into the Divisional Areas and assist the L.A.Ds. and Brigade Workshop recovery units. Under these same circumstances additional recovery assistance may be given by R.C.A.S.C. Transporter Companies, engaged normally in bringing up new equipment.

One of the less functional yet very essential items that go with the formation of any new corps is the designing of badges, buttons, flashes, cap colours, etc.

This matter involved the consideration of many and varied suggestions as to the design and colour of badges—the conscientious efforts of interested amateur and professional designers.

The adopted badge design is shown on the cover of this issue. The shields represent the three divisions of maintenance, i.e. Armaments, Telecommunications and Vehicles. The wreath is the traditional heraldic laurel design representing victory and the surmounting crown symbolizes the Sovereign ownership.

The colours of the Corps follow those of the British R.E.M.E. which are dark blue, yellow and red—derived by combining the colours of the R.C.O.C., R.C.A.S.C. and R.C.E.

The buttons, which incidentally are not likely to appear during this war, are simple in design and contain just a single gun of the same design appearing on the Armament shield in the R.C.E.M.E. badge.

This, then, is R.C.E.M.E.—new in name but wise in experience gained from the parent R.E.M.E. Corps in North Africa, Sicily and Italy, which has already established an enviable record and does honour to the Corp's from which it was formed. It will most certainly make a name for itself in this war and its inception will be remembered as a step forward in military organization and efficiency.

Oil bath breather must be filled with engine oil of specified viscosity, only to level marked (approximately 1/5 Imperial pint).

When adapter is used (with Zenith Carburetors) plug the saw cut with dum-dum or oil soaked felt strip.

Felt must compress at least 1/16" when clamps are tightened and joint must not come in same position as saw cut in elbow.

Check Hydrovent to be sure that it is functioning satisfactorily.

Dust caps on sparks plugs are used to prevent dust accumulation. Dust will collect moisture, causing short circuiting.

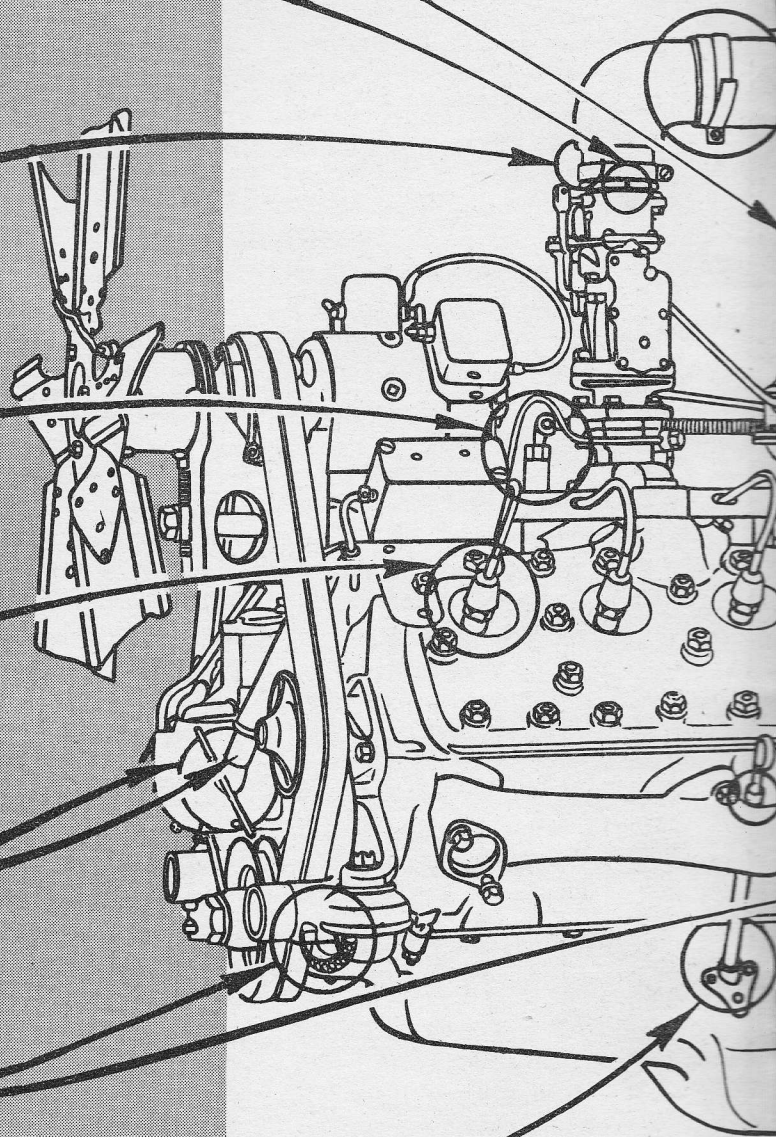
Be sure that distributor cap gaskets and rubber sleeves are not damaged and are in good condition.

Front and rear crankshaft bearing seals must be oil tight to be dust tight.

Dip stick tube must be kept tight.

The Dust, sand and inside of your engine ca its time. Even with kept up to snuff some dirty work unless you show here on our conc proofers Chart.

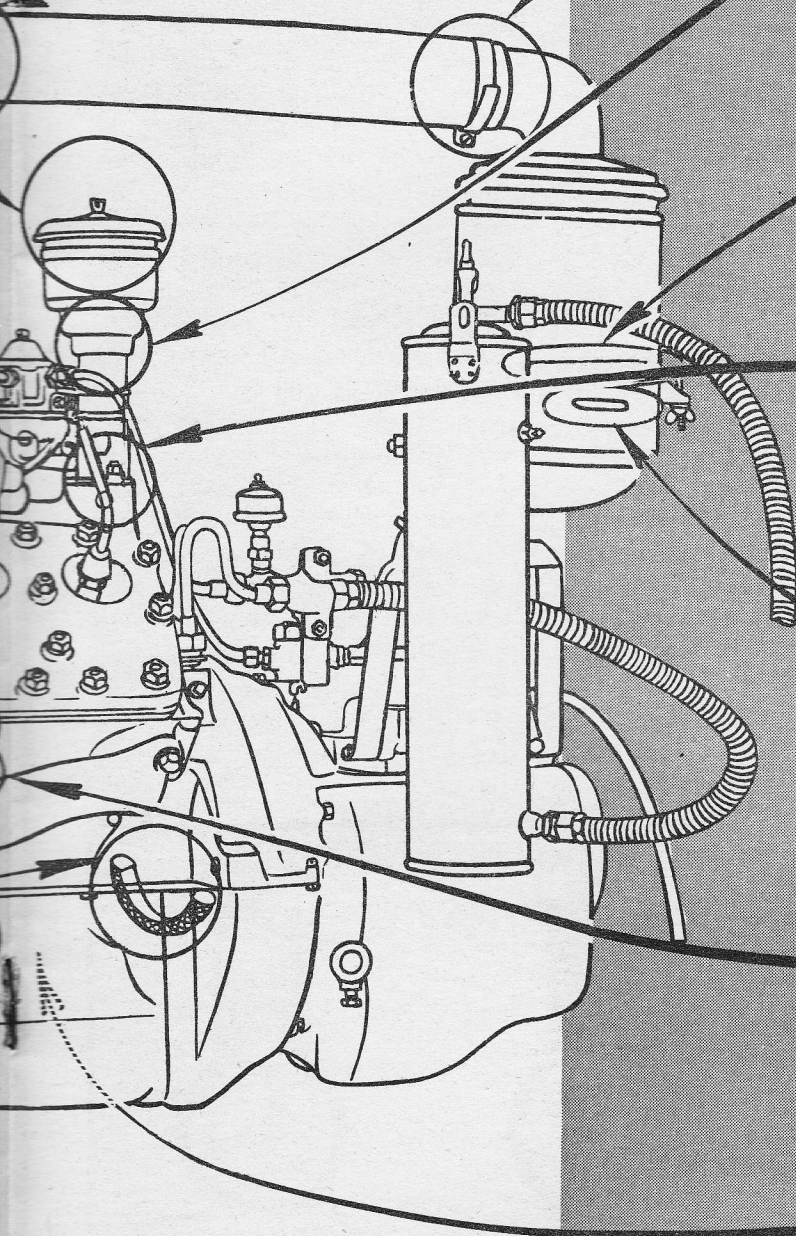
This is a Universal same plan will apply t



WHAT EVERY YOUNG MAN SHOULD KNOW ABOUT DUST

grit that sneaks into the
causes it to grow old before
your oil bath air filters
can still slip in to do its
go after all the places we
ise and unabridged Dust-

l Carrier engine but the
o any engine.



ALL joints must be air tight.

Felt seal should be soaked in
engine oil. Cap must be pulled
down tightly on breather pipe.

Air cleaner gasket must be tight
and unbroken at all times.

Fuel pump adapter must be down
tight on gasket between baffle and
manifold.

Fill reservoir of oil bath air
cleaner to indicated level (not above)
with engine oil of specified viscosity.
When oil level rises to danger point
because of dust accumulations, clean
and refill to proper level.

Flanged stop on oil gauge dip stick
must be down tight on tube.

Be sure that Starter Motor brush
cover band is covering "brush in-
spection holes" on starter motor
housing.

T PROOFING ENGINES FOR CROSS COUNTRY OPERATION



The Two-Cycle Engine

JOE is the kind of fellow that likes to get a close up look every time he sees a piece of motorized equipment—to see what sort of a power unit its got. With a gleam in his eye, he'll ogle over a Deisel, peer at a radial and stare at four's, sixes, V8's (and blondes). Eventually in his travels, he gets to hanging his nose over a two-cycle job. The gleam leaves his eye. "A putt-putt," he snorts, "Wotsit doin' in the army? Whersa valves? Whersa timing case? Howsit run?"

It's not hard to see that Joe

doesn't think much of a two-cycle engine.

Which was about the time we invited Joe over to the canteen for a short root beer and started in to sell him on the fact that the two-cycle is not such a bad little engine—in fact once understood, its reliability, simplicity and smoothness of operation make it something of a mechanical marvel. We had an idea that if Joe really understood the principles of its operation he'd get around to agreeing with us—and at the same time remember a couple of points about this engine that would save him from running into trouble if, and when, he ever had to take care of one.

As we explained to Joe, the first thing to get straight, is how the two-cycle engine operates. He knew the four-stroke cycle alright (Fig. 1). How the piston starts down with

the inlet valve open to draw in a charge of fuel—that's the intake stroke. The valves close and the piston comes up and compresses the fuel charge—the compression stroke. The power stroke is next—when the spark ignites the compressed fuel charge and the piston is driven down again and the fourth cycle—the Exhaust stroke occurs when the piston comes up, the exhaust valve opens, and the burned gases are pushed out—ready for the whole business to start over again.

As we reminded Joe, there has to be **two** complete revolutions of the crankshaft for every power stroke on this type of engine, while our two-cycle must intake, compress, ignite, and exhaust in only **one** revolution of the crankshaft—or two strokes of the piston. It's got to work fast and Fig. 2 shows how it manages to do all this and get itself a power

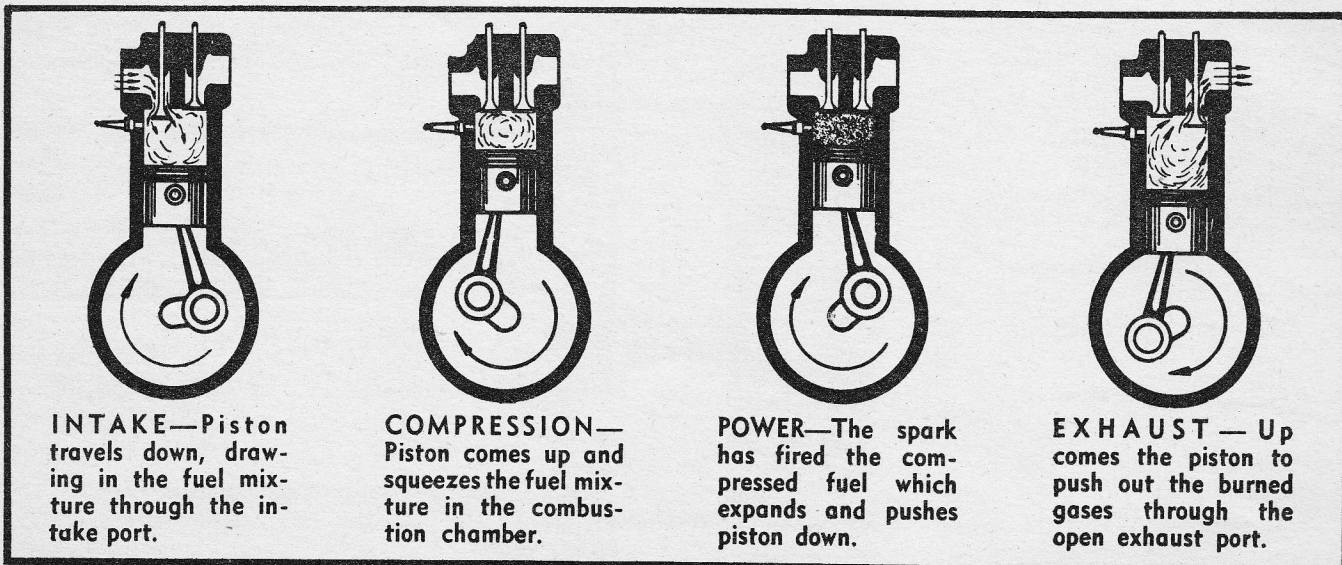


Fig. 1

stroke on every revolution.

"You'll notice, Joe," we said, "that on the upstroke of the piston a charge of fuel is drawn into the crankcase **below** the piston. At the same time the previous charge is getting itself compressed **above** the piston.

"The spark ignites this charge above the piston and we have our power stroke until the piston comes down enough to uncover the exhaust port. Meantime the fuel charge in the crankcase is getting compressed by the descending piston until the transfer port is uncovered—then it dashes up to its spot above the piston ready to get compressed when the piston comes up again. This charge from the crank-case is directed upwards to the top of the combustion chamber by the deflector hump on top of the piston—that's so that it doesn't scoot straight across and out the exhaust port, but instead, actually helps to scavenge the old burned gasses out."

This type of two-cycle engine is probably the simplest and is used in quite a few instances, mostly overseas, such as motorcycles, portable pumps, etc. The one you are likely to run into more often in Canada is the small Auxiliary Generator Set (Homelite) that lives in the Ram and Grizzly tanks. This engine uses a slightly different method of getting the same result (Fig. 3).

The fuel charge is brought directly into the crankcase via a rotating valve and is transferred to the combustion chamber by passing through a port in the skirt of the piston, and up through the transfer port. With the carburetor leading directly into the crankcase the valve must be used to seal it during the down stroke of the piston and is open to admit a fresh charge of fuel when the piston is going up.

"O.K.," says Joe. "It all sounds like straight goods and pretty simple

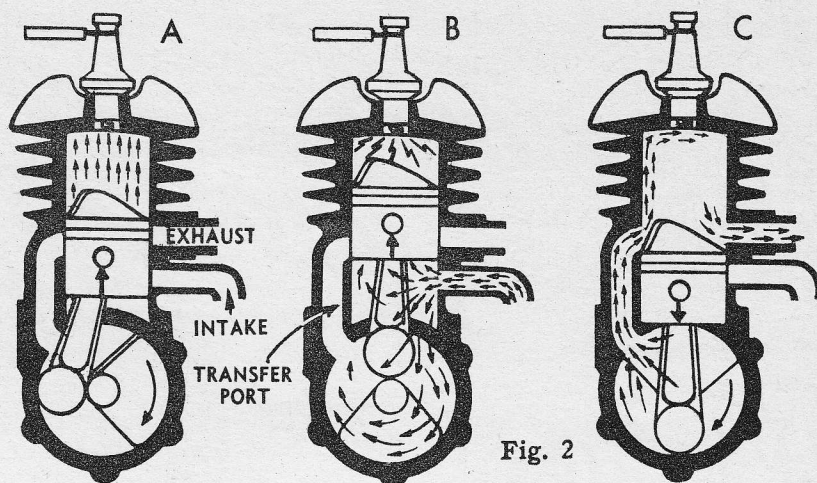


Fig. 2

'A' shows Piston going up—compressing fuel in combustion chamber and creating a "suction" in the crankcase.

'B' shows Piston has now uncovered intake port and low pressure in crankcase has drawn in a fresh charge from carburetor. At the same time the spark is firing the compressed charge above the piston and it starts down on its power stroke 'til it uncovers the exhaust port and also the transfer port. The "squeezed" fuel in crankcase now whisks up through the open transfer port and into the combustion chamber—helping push the burned gases out the exhaust port. The piston comes up as in 'A' compressing fuel in combustion chamber . . . see what we mean?

—but why do I see guys pulling their arms loose trying to start 'em. Or tearing 'em down more often than I try to fix my lighter—which is a continuous performance."

"Hold on", we say, passing Joe another root beer, "Before you condemn the motor maybe it's the guys themselves. Mebbe they're not hep to this two-cycle job like they think they are. Mebbe they don't even know how to properly lube it."

Which wasn't such an out of the way statement for us to make as we

knew for sure that some of these motors were being expected to run and lubricate themselves on straight gas.

Because there was no dipstick to check an oil level with it was forgotten altogether—which was a fatal business, for these motors depend on their lubrication being supplied by the passage of the fuel and oil charge through the engine. So the oil has to be mixed with the fuel. And that, we hastened to point out to Joe, means more than dumping 3/8 of a pint of oil in with each gallon of gas. It's got to be **mixed** with the gas—and that's where the fly gets into the grease pot.

Just tossing the oil into the gas tank causes two things.—Over lubrication at first and underlubrication later (Fig. 4 shows how). Both these things cause a flock of troubles on their own hook. With the excess oil in the bottom of the tank we're getting insufficient fuel. Supposing the engine does start—(and the fouling of the plug on the first few revolutions is more than likely)—too much oil is reaching the combustion chamber and we're making carbon to foul the ports and plugs faster'n

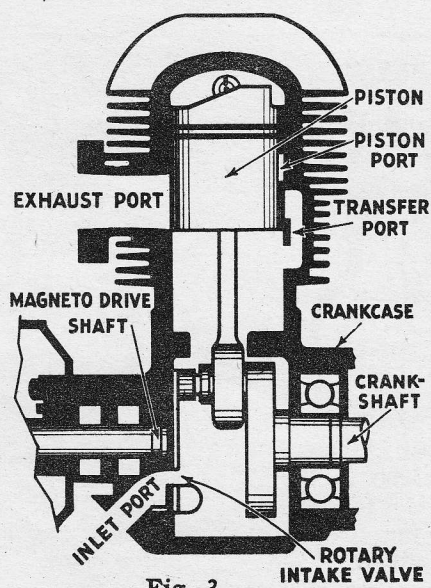


Fig. 3

you can say "this-rounds-on-me." In addition we've got a weak fuel mixture which causes the engine to run hot—with life reducing results.

After we've used the big share of our oil from the bottom of the tank we now start to get into the straight gas part that was at the top—and finally are getting no oil at all. This pure gas pouring into the crankcase just cuts the remaining oil from the bearings and cylinder walls and it's not long before everything grinds itself to bits—along with the serjeants disposition.

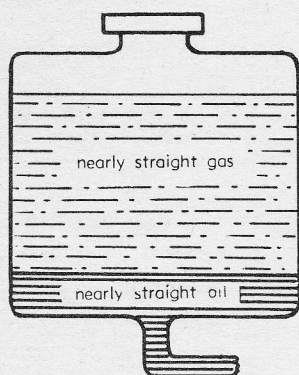


Fig. 4 GAS TANK

The correct way to mix the oil, as we demonstrated with Joe's root beer and some catsup, is like-a-this. Procure a gallon measure or can that's clean. Pour in 3/8 pt. of the correct grade oil. Then pour in just a quart or two of gasoline and stir with a clean wooden stick until it foams. Then fill the measure with the rest of the gallon of fuel and keep stirring 'till it's all well mixed. **Then pour the mixture** into the fuel tank. We passed this formulae to Joe as the number one preventive maintenance tip to remember with two-cycle engines.

There are others—definitely. But this one—the simplest one, of seeing that the oil is properly mixed with the gas, takes the long frown as the one most likely to stroke out your "two-stroke".

Using the correct type spark plug is another. These engines are hot. With a power stroke every revolution

they're bound to be. So a high temperature spark plug (like Champion J 10 commercial or equivalent) is a necessity—any other kind will give you as much trouble as Flattop gave Tracy. Inspect that spark plug regularly and replace every 25 hrs—When you take the plug out make a point of thoroughly cleaning both sides of the baffle.

One other thing we mentioned to Joe before we let go of him. The exhaust ports eventually get plugged with carbon. Up to a 1/4" deposit on the edge of the port nearest the crankcase will not affect the operation of the engine—but any appreciable formation on the other side will cause loss of power and overheating (Fig. 5)—just like late

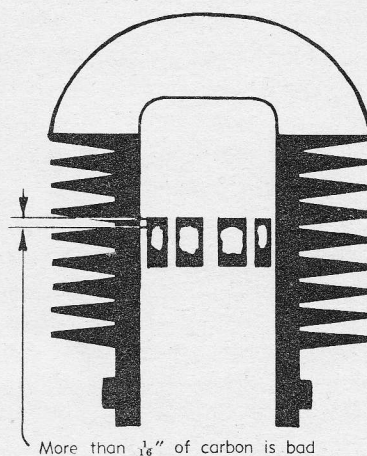
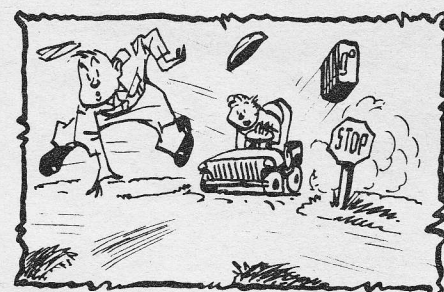


Fig. 5 EXHAUST PORTS with carbon

valve timing of a four-cycle engine.

Normal cleaning and correct adjustment of carburetor, a tightly sealed crankcase and properly adjusted points all contribute to a sweet running engine—and on this type motor these components are in their simplest form.

"Yes," we said to Joe that day, "It isn't the two-cycle motor that gives so much trouble—its the Joes who don't take the trouble to understand it—and take care of it. When they do—it turns out to be the simplest little motor they ever had working for them."



We still see lots of nice guys just like Pete, who drive hell out of their vehicles, just to get where they're going a couple of minutes sooner. If they get where they're going all in one piece they think they're good drivers. "Truck busters" we call them.

Zooming away from an intersection and then slamming on the brakes in the nick of time at the next intersection is bad business, especially if you have to pull on the hand brake to avoid an accident. The drive shaft brake,—small as it is—has a grip like a commando—and what it does to the drive line, ring gear and pinion parts when used as an emergency brake—should happen to Hitler.

In an emergency, the hand brake may be a help as a stopper-upper but why do some drivers always try to stop on a dime when they pull up to a stop sign? The main purpose of the parking brake is just like it says—and it does a swell job when used for parking.

Some dopes, like Pete, think that brake pedals are put there to jump on—but that's just plain sabotage. Good drivers know how to use their brakes properly. They never apply them suddenly unless its an emergency and they don't often have emergencies. Normal stopping is intelligently planned in advance by reducing the vehicles speed before it's necessary to stop. Just before the vehicle actually stops, the brakes are released and then re-applied gently. This keeps the back seat drivers from landing in your lap.

Technique you might call it—you can tell when a driver's got it as soon as he touches the brakes.

"Take it or leave it"

If you can pick the right answers to all of these questions—without using a Ouija board (pronounced Weegee ya dope) you can wear an Orphan Anny Commando badge and call your sergeant "Snookie".

TRADE TEST

- 1 A volt is a unit of (a) Current (b) Resistance (c) Electrical pressure (d) After effect of the wet canteen.
- 2 Ignition Coils are most efficient when they are (a) Warm (b) Hot (c) Cool (d) Doesn't matter.
- 3 The Storage Battery stores (a) Chemical energy (b) Electrical energy (c) Juice (d) Mechanical energy.
- 4 When cleaning commutators and seating the brushes on starting motors and generators use (a) Fine emery cloth (b) No. 00 Sandpaper (c) Fine file.
- 5 Generator voltage may be tested by connecting a Voltmeter between the armature terminal on the generator and ground, with the engine running. On a six volt system the voltmeter reading should never be above (a) 10 Volts (b) 8 Volts (c) 3.1416 Volts (d) 6 Volts.
- 6 The easiest method of checking for high fuel level in the carburetor bowl is to (a) Remove bowl cover and check height of fuel (b) Measure the height of float (c) Looking in air horn with engine stopped (d) Looking in air horn with engine idling.
- 7 The Vacuum Gauge readings of a normal motor at idling speeds should be between (a) 15" and 17" (b) 17" and 21" (c) 21" and 24" (d) 19 and 21 pounds.
- 8 A battery should be taken out of a vehicle and recharged if it's specific gravity is less than (a) 1.225 (b) 1.150 (c) 1.200 (d) 1.250.
- 9 The first and easiest item to check when a vehicle has a flat spot during acceleration is (a) Spark plugs (b) Condenser (c) Carburetor accelerating pump (d) Fuel pump.
- 10 Pitted distributor contact points usually indicate (a) Normal wear (b) High battery voltage (c) Run down battery (d) Incorrect condenser capacity.
- 11 The correct method of adjusting the spark plug gap is to (a) Bend ground electrode (b) Use ignition point file (c) Bend centre electrode (d) Bend both electrodes.
- 12 If either of the two distributor caps on a Ford V8 are not installed properly, the likely result will be (a) High battery voltage (b) Early ignition timing (c) Burned spark plugs (d) Broken Rotor.

Psst—As soon as the sarge leaves the room for a short beer turn the page and look up the answers. Then follow the sarge.



The right answers to our Ticklish Trade Test

- 1 (c) **ELECTRICAL PRESSURE.** The voltage of an electrical system is like "pounds per square inch pressure" in a hydraulic system.
- 2 (c) **COOL.** The resistance of the windings inside the coil will increase when the temperature increases which will result in poor coil performance.
- 3 (a) **CHEMICAL ENERGY.** The storage battery can't store electrical energy, but it does store chemical energy which can be converted or changed into electrical energy when it is required.
- 4 (b) **No. 00 SANDPAPER.** Fine sandpaper is used because if any particles become lodged between the commutator bars, they will not cause a short circuit. Particles of emery cloth on the other hand could cause a short circuit.
- 5 (b) **8 VOLTS.** All electrical units on a six volt system are designed to operate on six to eight volts. For a margin of safety, voltage regulators are usually adjusted to about $7\frac{1}{2}$ volts but the actual voltage at the generator will be slightly more than the voltage at the regulator.
- 6 (d) **LOOKING IN AIR HORN WITH ENGINE IDLING.** If the tip of the main nozzle flushes alternately wet and dry, it is a true indication of high fuel level in the carburetor bowl. Use an extension light or flash light to aid you to see properly, never use a naked flame unless you like flying.
- 7 (b) **17 to 21.** The vacuum of a normal motor at idling speeds (at or near sea level) should be between these figures and the vacuum gauge needle should be steady. The reading doesn't indicate pounds or miles or gallons, it's inches of mercury.
- 8 (a) **1.225 s.g.** When the battery has a specific gravity of 1.225 the battery is not completely discharged but nevertheless it is lower than it should be, therefore it should be brought up to full charge so that it is as efficient as possible. If the specific gravity is allowed to remain low, permanent damage to the battery may result.
- 9 (c) **CARBURETOR ACCELERATING PUMP.** This is a common cause of poor acceleration and is a simple matter to check. With the engine stopped—remove air cleaner and then operate the throttle by hand, at the same time take a peek in the air horn of the carburetor. Each time the throttle is opened there should be a clear stream of gasoline discharged into the centre of the venturi from the accelerating pump jet. No squirt—no work.
- 10 (d) **INCORRECT CONDENSER CAPACITY.** Vehicles that are operated continually at high speeds require a condenser of smaller capacity than a vehicle that is operated continually at slow speeds. The condensers installed by the manufacturers are designed for average operating conditions. If you find that the contacts do not last very long in a vehicle due to pitting and the hole is in the negative contact, the condenser is under capacity. If the hole is in the positive contact, the condenser has too much capacity for the type of driving the vehicle is getting. On a vehicle that has a negative grounded battery (as in Chevrolet) the grounded contact in the distributor would be negative. When the positive battery terminal is connected to ground (as in the Dodge) the grounded contact point in the distributor would be positive.
- 11 (a) **BEND GROUND ELECTRODE.** Never bend or pry on the centre electrode of the spark plug. You'll break the insulator if you do, and the sarge will break your neck if he catches you doing it.
- 12 (d) **BROKEN ROTOR.** Each of the two distributor caps on the Ford V8 (previous to 1942) must be installed properly. If the caps are improperly installed the rotor blades will likely hit the electrodes of the distributor cap when the engine is started. Very often this will result in a broken rotor. When installing the distributor caps make sure that the raised portion on the edge of the caps fit into the small recess in the aluminum distributor housing.

Well chum, how did you do? You couldn't get all the questions right 'til you looked at the answers? Good—You've learned something then—which was the dark plot behind the whole thing.

Do you know your joints?

BRASS fittings—those little connections used to hook up copper or steel gas and oil lines have been bothering some friends of ours in the field. Now, there's so little you have to know, to know ALL about the four most widely-used types of these fittings, that it's a shame to go around in the dark any longer.

So give eye, for here's the brief but complete story of these four types of fittings (and some of their relatives). Understand them now and you'll never have trouble again.

In the first place remember that we use BRASS fittings because they're rust-proof; in the second place, our brass connections are leak-proof—we'll tell you why later on.

The first type, is the "Compression Fitting" or sometimes called the "Solderless Compression Fitting". That's right Bud, it doesn't require solder to make it leakproof. The compression fitting consists of three parts, the body, the sleeve and the nut (Fig. 1). Before assembling the

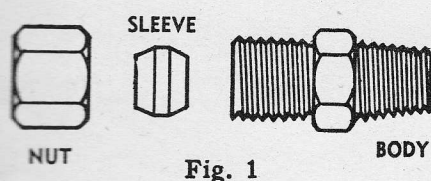


Fig. 1

fitting, the end of the tubing should be cut square, like a woman cuts bread only better. If possible use a tube cutter but in a pinch a hack saw will do. If you have to clamp the tubing in a vise, don't squash it out of round or it will leak like a lawn sprinkler. After the tubing is cut, the end should be filed square



and the inside reamed out slightly so that there won't be any bottle neck effect. Off the record we have found that an old file tang is suitable for doing this reaming job but be careful you don't distort the tubing. When repairing an old compression type joint, the tubing should be cut just behind the old sleeve and a new sleeve installed. The old nut and body can usually be used again.

When assembling the connection, the nut should first be put on the tubing then the sleeve is pushed on so that it is about one pipe diameter away from the end of the tube (Fig. 2). Now the tubing can be installed in the body and it should be held in place while the nut is tightened. As the nut is tightened, the sleeve will be compressed by the two shoulders, one inside the nut, and one inside

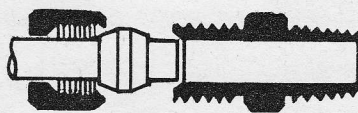


Fig. 2

the body, this will clamp the sleeve firmly on the tubing. The little fellow trying to squeeze into the mess hall will know what we mean.

Well so much for the "Compression type", now lets examine the gruesome facts about another old stand-by—the "S.A.E. Flared Type".

The flared type consists of two principle parts—the "tapered nut" and the "body" (Fig. 3). In using

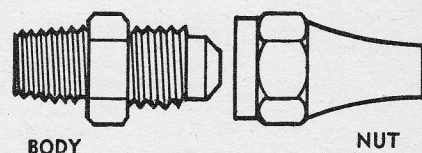


Fig. 3

this type of joint it is necessary to flare the tubing and this is where a couple of headaches will catch up with you if you don't watch out.

The first operation is to "prepare" the tubing for flaring. By this we mean you should cut the tubing to the proper length and then file it square and remove the burrs off the inside and outside. This operation is very important if you want to make



In the good old Summer Time!

★ TIRES

-overheat! Synthetics in particular on hot summer roads and long runs. Watch them closely—drive them slowly.

★ BATTERIES

-need checking twice as often as in winter time! Keep filler plugs tight, vents open, and the level just above the plates.

★ AIR CLEANERS

-start working overtime! Only constant servicing will keep road dust and grit away from the innards of your vehicle.

★ COOLING SYSTEMS

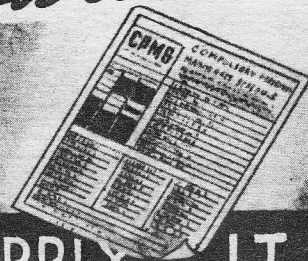
-have got to cool! They can't if they're dirty inside —and the rad is choked up with bugs outside.

★ LUBRICATION

-has a double job! to help dissipate heat and maintain a protective film in spite of it. The right lube in the right place will do this.

Preventive Maintenance

is essential!



YOU ARE THE ONLY ONE WHO CAN APPLY IT !